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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/749,019

12/29/2003

Sujian Huang

05516/056003

8429

7590

06/06/2006

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EXAMINER

FERRIS III, FRED O

ART UNIT

PAPER NUMBER

2128

DATE MAILED: 06/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/749,019

Applicant(s)

HUANG ET AL.

Examiner

Fred Ferris

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. *Claims 1-28 have been presented for examination based on applicant's disclosure filed 29 December 2003. Claims 1-28 stand rejected by the examiner.*

Drawings

2. *The drawings filed 21 October 2004 are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the must be shown or the features canceled from the claims. No new matter should be entered.*

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

MPEP Section 608.02(d) [R-2] "Complete Illustration in Drawings" recites the following:

"37 CFR 1.83. Content of drawing.

(a) The drawing in a nonprovisional application must show every feature of the invention specified in the claims. However, conventional features disclosed in the description and claims, where their detailed illustration is not essential for a proper understanding of the invention, should be illustrated in the drawing in the form of a graphical drawing symbol or a labeled representation"

In this case, none of the drawings (Figs. 1-17) appear to explicitly show the claimed elements or features relating to "determining the axial force" by "combining the

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axial force acting the cutting elements” as recited in independent claims 1 and 10 or the “combining the volume of each crater” recited in independent claims 5 and 16.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. *Claims 1-28 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-9 of U.S. Patent No.*

6,873,947. Although the conflicting claims are not identical, they are not patentably distinct from each other because:

Claims 1-28 include limitations relating to simulating drilling through and earth formation, determining axial force acting on cutting elements, and incrementally rotating the cutting elements (simulated) which appear as a subset of the limitations in claims 1-

9 of US 6,873,947. Specifically, claims 1-28 appear to “read on” the limitations relating to simulating drilling through and earth formation, determining axial force acting on cutting elements, and incrementally rotating the cutting elements appearing in claims 1-9 of US 6,527,068. (Also see: Fig. 3B-350) Here the “means for” determining axial force acting on cutting elements recited in the 947’ patent would obviously include features relating to calculating geometry of cutting elements and combining the axial forces as part of the “adjusting” (i.e. balancing) process.

4. Claims 1-28 are further rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-28 of U.S. Patent No. 6,785,641. Although the conflicting claims are not identical, they are not patentably distinct from each other because:

Claims 1-28 include limitations relating to simulating drilling through and earth formation, determining axial force acting on cutting elements, and incrementally rotating the cutting elements (simulated) which appear as an obvious of the limitations in claims 1-28 of US 6,785,641. Specifically, the limitations of claims 1-28 appear to be necessarily obvious as part of the features relating to determining and re-determining the loads on the drilling tool assembly based on “incremental rotation”, and further calculating and recalculating the dynamic response of the drilling tool under load as recited in claims 1-28 of the 641’ patent.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1-4, 10-15, and 22-28 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter.

Per claims 1-4, 10-15, and 22-28: The Examiner first submits that, in view of the language of the claims, independent claims 1, 10, and 22 are abstract and do not appear to recite a tangible result. In this case the result appears to merely be an abstract set of mathematical relationships (calculations) that are not used to achieve the intended application of determining an axial force on roller cones or balancing a volume of formation cut as recited in the preamble of the claims. The examiner submits that in order to establish a practical application, there must be either a physical transformation, or a useful, concrete and tangible result. Data transformation is not the same as a physical transformation. In this instance, there does not appear to be a tangible result. Here, the recited method steps appear to simply amount to mathematical calculations describing axial forces, and not a physical transformation. The claimed elements in this case, are simply a thought or computation, and not in and of themselves a tangible result. It is not until the transformation of the results of the claimed "calculations" and "combining the axial forces" are applied in a meaningful way that it has real world value and becomes a tangible result. Instead, the result appears to simply be an unapplied and un-stored number resulting from the calculation and combining of design parameters.

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MPEP 2106 recites the following:

"A. Identify and Understand Any Practical Application Asserted for the Invention

*The claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and **tangible result**." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "**real world**" value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); In re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)). Accordingly, a complete disclosure should contain some indication of the practical application for the claimed invention, i.e., why the applicant believes the claimed invention is useful.*

Apart from the utility requirement of 35 U.S.C. 101, usefulness under the patent eligibility standard requires significant functionality to be present to satisfy the useful result aspect of the practical application requirement. See Arrhythmia, 958 F.2d at 1057, 22 USPQ2d at 1036. Merely claiming nonfunctional descriptive material stored in a computer-readable medium does not make the invention eligible for patenting. For example, a claim directed to a word processing file stored on a disk may satisfy the utility requirement of 35 U.S.C. 101 since the information stored may have some "real world" value. However, the mere fact that the claim may satisfy the utility requirement of 35 U.S.C. 101 does not mean that a useful result is achieved under the practical application requirement. The claimed invention as a whole must produce a "useful, concrete and tangible" result to have a practical application.

Although the courts have yet to define the terms useful, concrete, and tangible in the context of the practical application requirement for purposes of these guidelines, the following examples illustrate claimed inventions that have a practical application because they produce useful, concrete, and tangible result:

*- Claims drawn to a long-distance telephone billing process containing mathematical algorithms were held to be directed to patentable subject matter because "the claimed process applies the Boolean principle to produce a useful, concrete, **tangible result** without pre-empting other uses of the mathematical principle." AT &T Corp. v. Excel Communications, Inc., 172 F.3d 1352, 1358, 50 USPQ2d 1447, 1452 (Fed. Cir. 1999);*

- "[T]ransformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces a useful, concrete and tangible result' -- a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601; and

*- Claims drawn to a rasterizer for converting discrete waveform data samples into anti-aliased pixel illumination intensity data to be displayed on a display means were held to be directed to patentable subject matter since the claims defined "a specific machine to produce a useful, concrete, and **tangible result**." In re Alappat, 33 F.3d 1526, 1544, 31 USPQ2d 1545, 1557 (Fed. Cir. 1994)."*

Dependent claims 2-4, 11-15, and 23-28 inherit the defects of the claims from which they depend.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. *Claims 1-28 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by U.S. Patent 6,213,225 issued to Chen.*

Independent claims 1 and 10 are drawn to:

*Determining/balancing axial force acting on roller cones during drilling, comprising:
calculating geometry of cutting elements on each roller cones and earth formation being drilled an axial force acting on cutting elements;
incrementally rotating bit and recalculating axial forces acting on cutting elements;
repeating incrementally rotating and recalculating for a selected number of incremental rotations;
combining the axial force acting on cutting elements of each roller cone
adjusting design parameters and repeating to minimize combined force*

Regarding independent claims 1, 10, and 22: Chen discloses simulating roller cone earth drilling by calculating roller cone element geometry (CL7-L36, CL7-L56 to CL8-L21), selecting parameters (CL5-L67, CL9-59), and simulated earth formation characteristics (CL10-L14, CL6-L57-CL7-9, CL9-L43). Chen further discloses calculating the axial force on cutting elements (Abstract, CL5-L36, CL7-L56 to CL8-L21, CL10-L45, CL1-L11-21), simulating an incrementally rotating bit (CL11-L34-39, CL10-

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L47-63, CL8-L41-53, CL7-L52), and recalculating cutting element forces based on design parameter (CL8-L37-CL9-L57, CL10-L2, CL11-L7, Fig. 6). Chen also discloses repeating the simulation (CL10-L2, CL11-L7) and determining each axial force by combining axial forces on cutting elements (CL11-L11-21), and combining crater volumes for each cutting element to determine each rollers contribution (CL11-35).

(Also see: Abstract, Background, CL6-L 57, CL7-L56, CL8-L28, Figs. 1-9)

Regarding dependent claims 2, 3, 11, and 12: Dependent claims 2, 3, 11, and 12 include limitations drawn to total axial drill forces on cutting elements of the drill bit (Abstract, CL5-L36, CL7-L56 to CL8-L21, CL10-L45, CL1-L11-21) and simulating an incrementally rotating bit (CL11-L34-39, CL10-L47-63, CL8-L41-53, CL7-L52) and are rejected using the same reasoning as cited above. Chen also discloses simulating the depth of penetration (CL14-L2, CL2-L20).

Regarding dependent claims 4, 13: Claims 4, and 13 include limitations relating to the use of experimental (laboratory) earth formation and is anticipated by the experimental penetration results disclosed by Chen. (CL5-L9, CL7-L37, Fig. 6)

Independent claims 5 and 16 are drawn to:

determining volume of formation cut by each roller cone drilling earth formations comprising:

selecting bit design parameters, comprising geometry of cutting element on the drill bit;
selecting earth formation;

calculating from selected bit design and earth formation parameters for crater formed when each roller cone cutting element contacts the earth formation, parameters
volume of crater;

incrementally rotating the bit, and

repeating calculating crater parameters for selected number of incremental rotations;

combining volume of each crater formed by each roller cone cutting element to

determine volume cut by each roller cone

adjusting design parameters and repeating to minimize combined force

Regarding independent claims 5 and 16: Chen discloses balancing the axial forces on a roller cone drill bit (CL4-45 to CL5-65, CL7-L56 to CL8-L21), and balancing the volume of formation (rock) cut (CL5-39, CL6-L60-CL9-45, Especially CL9-L20) by each simulated roller cone (CL11-L8, CL9-L20). Chen further discloses calculating the axial force on cutting elements (Abstract, CL5-L36, CL7-L56 to CL8-L21, CL10-L45, CL1-L11-21), simulating an incrementally rotating bit (CL11-L34-39, CL10-L47-63, CL8-L41-53, CL7-L52), and recalculating cutting element forces based on adjusted design parameters (CL8-L37-CL9-L57, CL10-L2, CL11-L7, Fig. 6). Chen also discloses repeating the simulation and adjusting design parameter (i.e. repeating until “optimized” over the prior simulation: CL10-L2, CL11-L7), determining each axial force by combining axial forces on cutting elements (CL11-L11-21), and selection of design parameters including the number of cutting (teeth) elements (CL8-L27-47). (Also see: Abstract, Background, CL6-L 57, CL7-L56, CL8-L28, Figs. 1-9)

Regarding dependent claims 6-8, 17-19, and 23-27: Dependent claims 6-8 and 17-19, and 223-27 include limitations drawn to further determining/calculating axial forces on cutting elements and crated volume based in incremental rotation and are anticipated by the simulating an incrementally rotating bit (CL11-L34-39, CL10-L47-63, CL8-L41-53, CL7-L52), recalculating cutting element forces based on adjusted design parameters (CL8-L37-CL9-L57, CL10-L2, CL11-L7, Fig. 6), repeating the simulation and adjusting design parameter (i.e. repeating until “optimized” over the prior simulation: CL10-L2, CL11-L7), determining each axial force by combining axial forces on cutting

elements (CL11-L11-21), and selection of design parameters including the number of cutting (teeth) elements (CL8-L27-47) as noted above and disclosed by Chen. Chen also discloses simulating the depth of penetration (CL14-L2, CL2-L20).

Regarding dependent claims 9, 28: Claims 9, and 28 include limitations relating to the use of experimental (laboratory) earth formation and is anticipated by the experimental penetration results disclosed by Chen. (CL5-L9, CL7-L37)

Regarding dependent claims 14, 15, 20 and 21: These claims include limitations relating to the number and location of cutting elements and are anticipated design parameters (CL8-L27-47) disclosed by Chen as noted above.

7. Claims 22-28 are also rejected under 35 U.S.C. 102(b) as being clearly anticipated by “The Operational Mechanics of The Rock Bit”, Ma et al, Petroleum Industry Press, Copyright 1996.

Regarding claims 22-28: Ma et al discloses techniques for optimizing the design of a roller bit (chapter 6) drilling a simulated earth formation (chapter 5), the operational mechanics of roller bit geometry and cutting elements (chapter 2, 6.1), the kinematics of the bit (teeth, rollers, scraping formation, etc. chapter 3), rock and bit iteration (volume, etc. chapter 5), and bit design parameters and force analysis (optimize using computer simulation by size, load, motion, stress, etc. chapter 6, section 5.4, especially page 232, based on the entire teaching).

Conclusion

8. *The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.*

U.S. Patent 6,021,377 issued to Dubinsky et al teaches drilling simulation.

"The Computer Simulation of the Interaction Between Roller Bit and Rock", Ma, Society of Petroleum Engineers, SPE 29922, November 1995 teaches drilling simulation.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 571-272-3778 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 571-272-3700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached at 571-272-2279. The Official Fax Number is: (703) 872-9306

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